REMARKS

I. STATUS OF APPLICATION

No claims are added, canceled, or amended in this paper. Therefore, claims 22-28 and 32-44 are pending in the present Application. Claims 27, 28, and 32-44 stand withdrawn from consideration due to a Restriction Requirement.

Claims 22-26 stand rejected under 35 USC § 102(b) as anticipated by, or, in the alternative, under 35 USC § 103(a), as obvious over U.S. Patent 4,888,228 to Sidles ("Sidles").

II. RESTRICTION REQUIREMENT

Applicant affirms the election of claims 22-26.

III. 35 USC § 102/103 REJECTIONS

Claims 22-26 stand rejected under 35 USC § 102(b) as anticipated by, or, in the alternative, under 35 USC § 103(a), as obvious over Sidles. The rejections are respectfully traversed, as discussed *infra*.

A. Claims 22-26 are not anticipated by Sidles

Independent claim 22 requires "infusing a resin material through each preform and the overlapped Z-direction fibers and loops." The Office, pointing to column 2, line 60, through column 3, line 4 of Sidles, alleges that "the reference taught than an organic binder was supplied to the preforms."[1] Sidles teaches "an organic binder which is applied to one or both sides of the substrate. The first and second plies 15, 20 are

[1] Detailed Action, p. 4, l. 1.

stacked so that the binder 40 is dispersed between the plies."[2] Claim 22 recites the phrase "infusing a resin material," which Applicants respectfully assert is a term of art. In Fundamentals of Composites Manufacturing: Materials, Methods and Applications:[3]

> *All of the resin infusion technologies share some common features. In all of them, dry (without resin) fiber preform is placed into a mold and the mold is closed. Resin is then injected into the mold so that the preform is fully wetted with resin.*[4]

Applicant's Specification teaches:

> *In Figure 13, two preforms 141 and 143 are infused together to form a co-cured reinforced joint 145. In this example, each part 141 and 143 includes exposed Z-direction reinforcement fibers 147. The parts are placed together so that the Z-direction fibers co-mingle, and then resin is infused through both parts 141 and 143. A resin infusion path is shown as curve F*

(emphasis added).[5]

Applicants respectfully assert that one of ordinary skill in the art would understand that Sidles fails to teach "infusing a resin material through each preform and the overlapped Z-direction fibers and loops," as required by independent claim 22, as well as claims 23-26, which depend therefrom. An anticipating reference, by definition, must disclose every limitation of the rejected claim in the same relationship to one another as set forth in the claim.[6] As Sidles fails to achieve this standard, Applicants respectfully assert that Sidles cannot anticipate the present invention, as set forth in claims 22-26.

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[2] Sidles, col. 2, ll. 46-49.
[3] A. Brent Strong, *Fundamentals of Composites Manufacturing: Materials, Methods and Applications*, Society of Manufacturing Engineers, 2007, pp. 417-418, a copy of which is provided herewith for the convenience of the Examiner.
[4] Strong, p. 417, left column, l. 28, through right column, l. 2.
[5] Specification, p. 14, ll. 18-23, and Figure 13 of the present Application.
[6] *In re Bond*, 15 U.S.P.Q.2d (BNA) 1566, 1567 (Fed. Cir. 1990).

Accordingly, it is respectfully requested that the rejection of claims 22-26 under 35 USC § 102(b), as being anticipated by Sidles, be reconsidered and withdrawn.

B. Claims 22-26 are not rendered obvious by Sidles

As discussed *supra* concerning the 102(b) rejection over Sidles, Sidles fails to disclose "infusing a resin material through each preform and the overlapped Z-direction fibers and loops," as required by independent claim 22, as well as claims 23-26, which depend therefrom. The Office has provided no allegations concerning this limitation of the rejected claims, other than to allege that Sidles teaches the limitation. Accordingly, Applicants respectfully assert that Sidles fails to render obvious the present invention, as set forth in claims 22-26.

It is, therefore, respectfully requested that the rejection of claims 22-26 under 35 USC § 103(a), as being unpatentable over Sidles, be reconsidered and withdrawn.

IV. DISTINCTIONS, OTHER THAN THOSE DISCUSSED, MAY EXIST

Note that Applicant has merely discussed example distinctions from the various references cited by the Office. Other distinctions may exist and Applicant reserves the right to discuss these additional distinctions in a future Response or on Appeal. By not responding to the additional statements made by the Examiner, Applicant does not acquiesce to the Examiner's additional statements. The remarks provided above are sufficient to overcome the Office's rejections.

CONCLUSION

Wherefore, in view of the foregoing remarks, this application is considered to be in condition for allowance, and an early reconsideration and issuance of a Notice of Allowance are earnestly solicited. The Examiner is invited to contact the undersigned at (817) 578-8616 with any questions, comments, or suggestions relating to the referenced patent application.

Respectfully submitted,

20 August 2008
Date

/darencdavis#38425/

James E. Walton, Registration No. 47,245
Daren C. Davis, Registration No. 38,425
Brian E. Harris, Registration No. 48,383

Law Offices of James E. Walton, P.L.L.C.
1169 N. Burleson Blvd., Suite 107-328
Burleson, Texas 76028
(817) 578-8616 (Direct)
(817) 447-9955 (Main)
(817) 447-9954 (Facsimile)
jim@waltonpllc.com (Email)

CUSTOMER NO. 38441
ATTORNEY AND AGENTS FOR APPLICANT

Fundamentals of
Composites Manufacturing

16

Resin Infusion Technologies

CHAPTER OVERVIEW

This chapter examines the following concepts:

- Process overview
- Resin infusion technologies
- Equipment and process parameters
- Preform technology for infusion
- Resin characteristics
- Core and flow media materials
- Part design for resin infusion
- Centrifugal casting

PROCESS OVERVIEW

Besides being the best known of the many **resin infusion technologies** for making composite parts, **resin transfer molding (RTM)** is often the general term used for all resin infusion processes. However, in this text, RTM is used in a more narrow sense and "resin infusion" is the more general term. Another phrase occasionally used to describe the resin infusion processes is **liquid molding processes**. (Consult the "Liquid Molding" video, SME 2005 for a look at the equipment and techniques of liquid molding processes. These videos are excellent supplements to lectures and laboratories.)

All of the resin infusion technologies share some common features. In all of them the dry (without resin) fiber preform is placed into a mold and the mold is closed. Resin is then injected into the mold so that the preform is fully wetted with resin. The resin is cured, the mold is opened, and the part is extracted. The basic resin infusion process is illustrated in Figure 16-1.

The advantages of the resin infusion processes, listed in Table 16-1, are immediately apparent. The factors especially appealing in the current composite world are: the better quality possible with resin infusion (good tolerances that are repeatable and excellent surfaces out of the mold); lower emissions; low labor requirements; low requirements for auxiliary equipment (like freezers and autoclaves); and the degree of design flexibility in both part size and complexity. Cycle times depend on the resin system used but typically fall in the range of 5–10 minutes. However, they can be as high as 2–8 hours for large parts like railroad cars and yachts. Inserts can be easily molded in and this means that one-piece, co-cured parts are often easy to make, thus reducing the total number of parts in an assembly.

An important advantage of the process that might not be obvious at first thought is the feature of being able to place continuous fibers (that is, continuous across the part) into the mold and then carrying out the molding operation without moving the fibers. This means that resin infusion can be used to make advanced composite parts where the direction of the fibers is critical to part performance. In addition, the ability to use low-cost materials and the speed

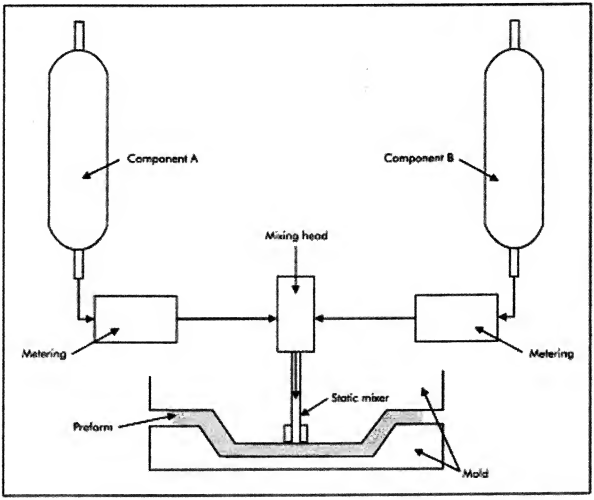

Figure 16-1. Basic resin infusion process.

of manufacture allow resin infusion to be used for engineering composites.

In engineering composites, resin infusion surpasses BMC and at least equals SMC in mechanical performance. This is because the fibers do not need to move in the mold. The operational costs of resin infusion are about equivalent to BMC and SMC but the material is slightly higher because it is difficult to add fillers. (They are sometimes separated from the resin as the resin/filler mixture infiltrates through the fiber preform.) However, other costs such as the reduction in auxiliary equipment needed and the environmental aspects of resin infusion often result in it being the lowest-cost molding process. Hence, the process is likely to be important across the entire spectrum of composites manufacturing. The use of infusion processes is growing rapidly for both new parts and those that were previously made by other composites processes.

The disadvantages of resin infusion processes, also listed in Table 16-1, are not